Space Weather Technical Forecast

Issued on Tuesday, 07 November 2023 at 12:42 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Storms Day 1 (07 Nov), risk then declining. Slight Chance of M-class flares. Chance of Active fluence (1e8 integrated pfu) by Days 3 and 4 (09-10 Nov).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with only C-class flares observed in the last 24 hours. AR3477 and AR3480 are the two largest regions on the visible disc, but neither is showing any significant magnetic complexity. The remaining two numbered and one un-numbered regions on the disc are small and simple at present.

No Earth directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds at L1, as observed by DSCOVR and ACE, showed the onset of a High Speed Stream (HSS) from CH67/-. Wind speeds were initially elevated or slightly elevated, around 450-550 km/s, but increased to become strong above 600 km/s after 06/1200 UTC. Density was average or slightly above at first, soon settling at average to below average levels. Total magnetic field strength (Bt) followed a very similar trend, peaking around 13nT at first, but soon eased to become weak. The north-south component (Bz) varied moderately initially, but is now varying only weakly. Phi angle has been predominantly negative (towards the Sun), with just a few brief variations. Geomagnetic activity has been Quiet to Active (Kp 2-4), but with a couple of G1/Minor Storm (Kp 5) intervals 06/1800-2100UTC and 07/0000-0300UTC, as observed by BGS.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux has been at background levels over the last 24 hours. GOES16 high energy (greater than 2MeV) electron flux was at background levels but has risen to moderate levels since midnight UTC. The associated 24-hour fluence has been well below the Active threshold (1e8 integrated pfu) but has risen more quickly since midnight UTC. The fluence observation at 07/0000 UTC was 1.63e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected through the next four days, with a slight chance of isolated M-class flares, mainly from AR3477 and AR3480.

Solar Wind / Geomagnetic Activity: No further CMEs are currently forecast to reach Earth. Solar wind speeds are at strong levels, above 600 km/s, due to the HSS from coronal hole 67. Strong wind speeds are likely to continue through Day 1 into Day 2 (07-08 Nov), before a gradual decline through Days 3 and 4 (09-10 Nov).

Geomagnetic activity is likely to be Quiet to Active, with a chance of isolated G1/Minor Storm intervals on Day 1. Activity is expected to gradually decline through the following days as the HSS eases.

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Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is most likely to remain at background levels. High energy electron flux (greater than 2MeV) is currently at moderate levels. A sharp increase in flux is possible in the coming days as the solar wind eases and the radiation belt relaxes, with high levels possible. Associated 24-hour electron flux is likely to rise, with a chance of fluence exceeding the Active (1e8 integrated pfu) threshold by Days 3 and 4 (09 and 10 Nov).

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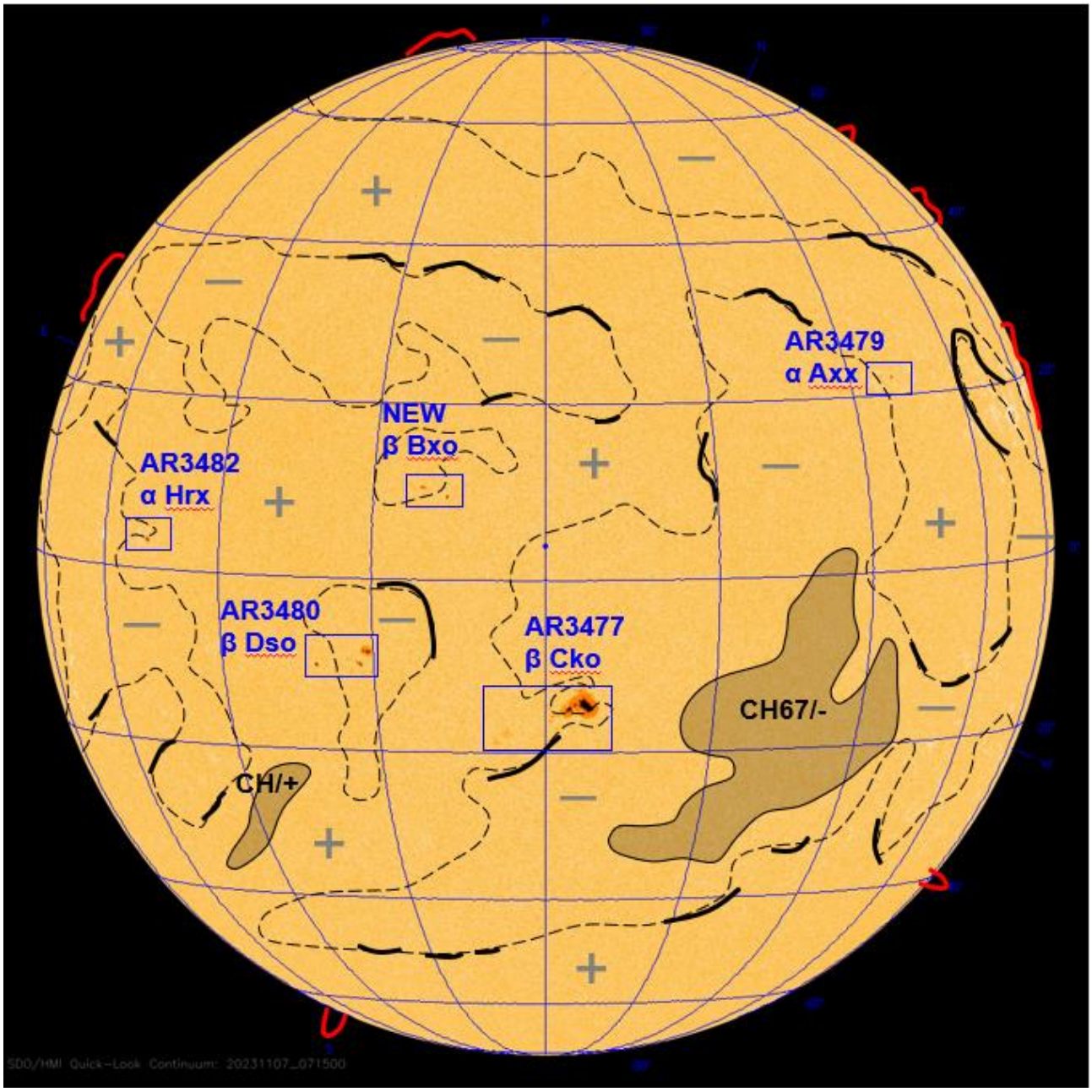
Figure 1. Solar Analysis Valid 07/0730UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

With the previous CME effects now having waned, no further CMEs are currently forecast to reach Earth.

Solar wind speeds are at strong levels, above 600 km/s, due to the HSS from coronal hole 67. Any Co-rotating Interaction Region (CIR) at the onset of the HSS was likely masked by the waning CME effects, but with the strong wind speeds some further minor geomagnetic activity is likely from this feature. The coronal hole is reasonably large, suggesting strong wind speeds are likely to continue through Day 1 into Day 2 (07-08 Nov), before a gradual decline in wind speeds through Days 3 and 4 (09-10 Nov). Although this feature was present on the previous rotation, persistence is not a particularly helpful guide as the HSS arrived several days later and was weaker last time around.

Geomagnetic activity is likely to be Quiet to Active, with a chance of isolated G1/Minor Storm intervals on Day 1. Activity is expected to gradually decline through the following days as the HSS eases.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	Yes	50	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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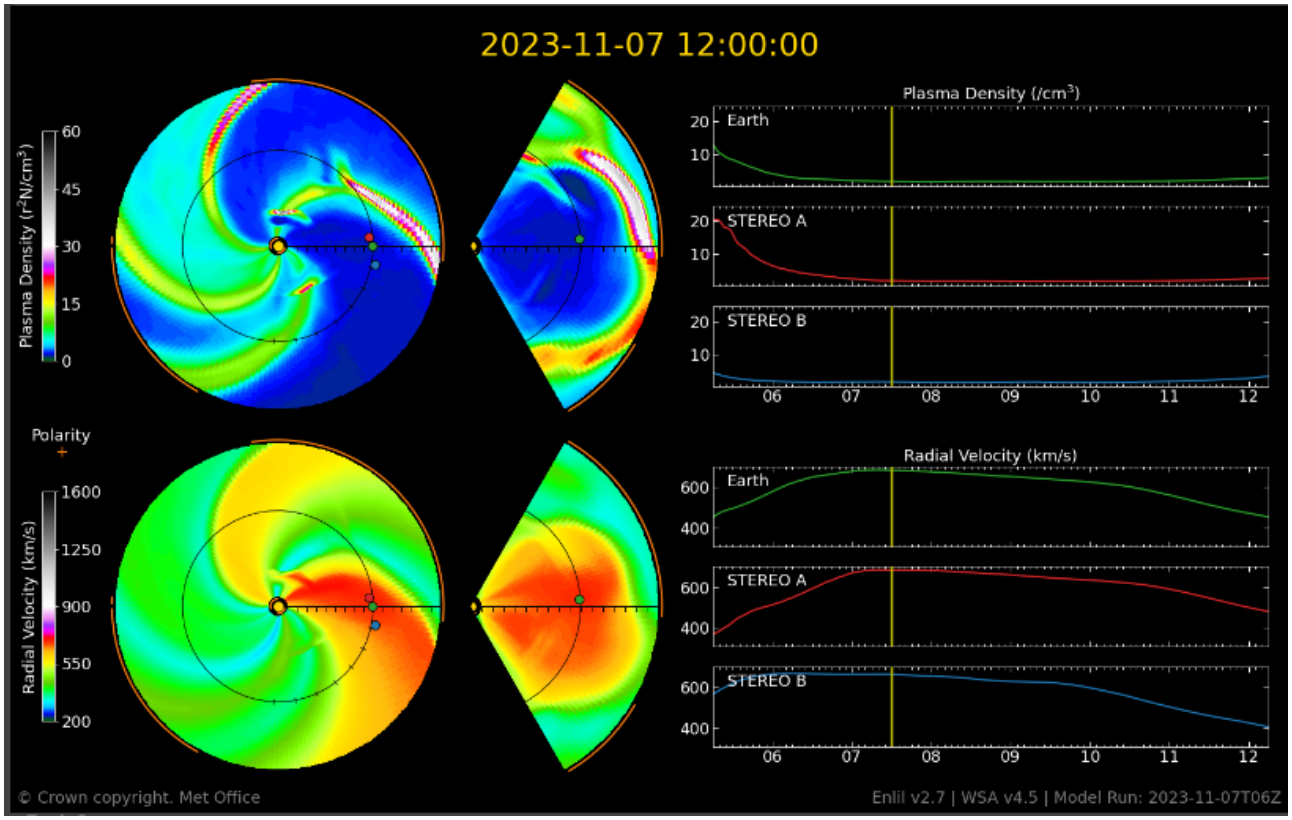
Figure 2: MOSWOC Enlil forecast.



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Radio Blackouts - X-Ray Flares:

Activity has been Low with only C-class flares in the last 24 hours. AR3477 and AR3480 are the two largest regions on the visible disc, but neither is showing any significant magnetic complexity. The remaining two numbered and one un-numbered regions on the disc are both small and simple at present, with no further large regions due to rotate into the visible side of the Sun.

AR3472 and AR3474 are both now beyond the western limb, with the risk of flaring from these regions diminishing.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels. There is a slight risk of proton enhancement at first from ex-AR3472 and ex-AR3474, but as these regions rotate further beyond the west limb the risk reduces. Neither AR3477 or AR3480 are particularly complex, so these regions have a very minimal risk associated with them.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	2	2	2
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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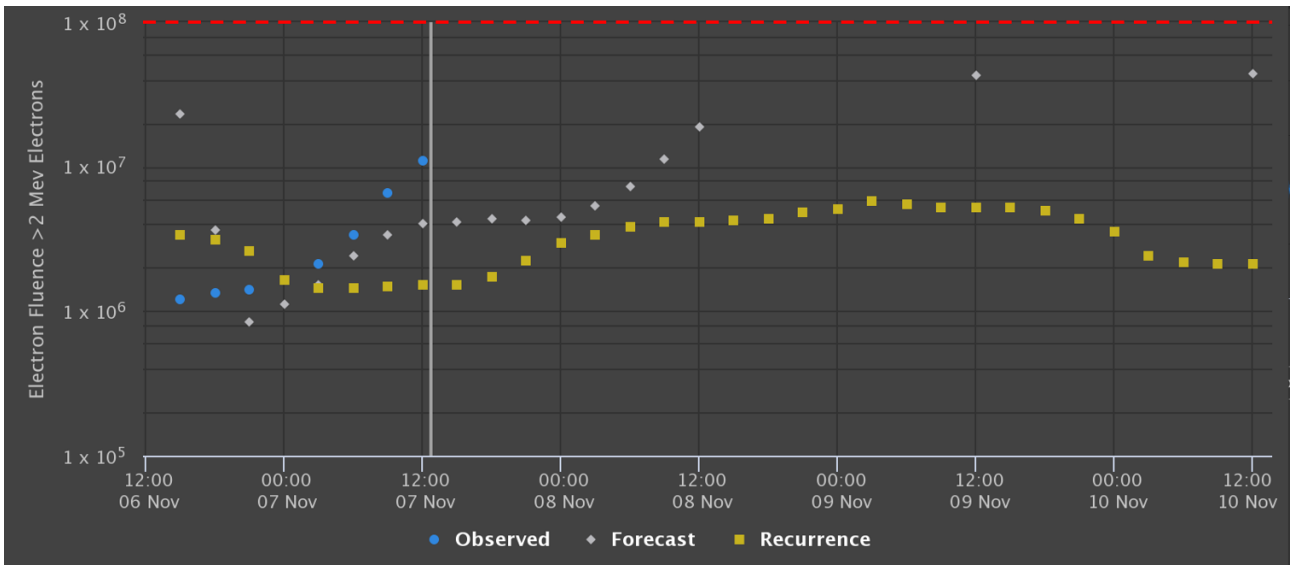
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) has risen to moderate levels. A flux increase in the radiation belt is considered likely after the recent CME effects, followed by the strong wind speeds. A sharp recovery in flux is therefore possible in the coming days as the solar wind eases and the radiation belt relaxes, with high levels possible.

Associated 24-hour electron flux is expected to be below the Active threshold at first, with the potential for a sharp increase during this period. There is a chance of fluence exceeding the Active (1e8 integrated pfu) threshold by Days 3 and 4 (09 and 10 Nov). Confidence is reasonable in the possibility of an increase, but low for the timing and magnitude of this. MOSWOC REFM is forecasting an increase below the Active threshold, although this is only for the next 3 days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	20	40	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM latest output.



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